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Nanoparticles Cooperate to Detect and Treat Tumors

If one nanoparticle is good, two may be better, especially when they are designed to cooperate with each other to diagnose and treat cancer. That finding comes from work led by Michael Sailor, Ph.D., a member of the Center of Nanotechnology for Treatment, Understanding, and Monitoring of Cancer at the University of California, San Diego, and published in the journal *Advanced Materials*.

Dr. Sailor and his colleagues, including fellow Center member Erkki Ruoslahti, M.D., Ph.D., of the Burnham Institute for Medical Research at the University of California, Santa Barbara, and Sangeeta Bhatia of the Howard Hughes Medical Institute and a member of the MIT-Harvard Center for Cancer Nanotechnology Excellence, have had success developing multifunctional nanoparticles that incorporate several functions – imaging and drug delivery, for example – in one nanoparticle. However, the investigators felt that fitting multiple functions into one nanoparticle was sometimes problematic in terms of getting the right combination of properties needed to fulfill two or more missions inside the body.

For this study, Dr. Sailor and his collaborators decided to create two nanoparticles. One, a polymer-coated gold nanorod, was designed to accumulate in tumors and become warm when irradiated with near infrared light. The second nanoparticle, made of a thermally responsive lipid mixture, was designed to release a drug payload only when encountering cells warmed to 45° C, that is, only where the first nanoparticle had heated tumors.

After injecting the two nanoparticles together into tumor-bearing mice, the investigators illuminated tumors with near infrared light. They then observed that the drug-containing nanoparticles began accumulating and releasing their drug around the tumors. More importantly, the researchers found that the drug killed more cells when the two nanoparticles were used in combination than it did when administered alone or when just the drug-loaded nanoparticle was used. Dr. Sailor's team also observed that subsequent tumor growth was significantly impaired, while the treated mice displayed few adverse side effects from the therapy.

This work, which is detailed in a paper titled, "Cooperative Nanoparticles for Tumor Detection and Photothermally Triggered Drug Delivery," was supported by the NCI Alliance for Nanotechnology in Cancer, a comprehensive initiative designed to accelerate the application of nanotechnology to the prevention, diagnosis, and treatment of cancer. An abstract of this paper is available at the journal's Web site.

View abstract